IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re U.S. Patent Application of	)	
	)	**Group Art Unit: 3724**
Jau-Yuen SU et al.	)	
	)	
Application Number: 09/394,918	)	**Examiner: Omar FLORES-SANCHEZ**
	)	
Filed: September 13, 1999	)	**Confirmation No.: 5130**
	)	
For: PROCESS FOR SAWING SUBSTRATE STRIP	)	**Attorney Docket: SUJA3001/WKP**
	)	**Customer No.: 23364**

APPELLANT'S BRIEF UNDER 37 C.F.R. § 1.192

MAIL STOP APPEAL BRIEF-PATENTS
Honorable Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This paper is an Appeal Brief resubmitted to place same in full compliance with the Notification of Non-Compliance dated January 12, 2004, in furtherance of the Notice of Appeal filed in this case on July 28, 2003.

This Brief contains these items under the following headings and in the order set forth below:

XI. **Appendix of Specification (incorporating all previously entered amendments)**

XII. **Appendix of Abstract (as previously amended)**

XIII. **Appendix of Drawings (as originally filed)**

XIV. **Appendix of Dictionary Definition**

I. Real Party In Interest

The real party in interest is the assignee, Advanced Semiconductor Engineering, Inc. of Kaohsiung, Taiwan, R.O.C. An assignment of the application from the Appellants, Jau-Yuen Su, Tao-Yu Chen and Su Tao, was recorded on September 13, 1999 at reel 010258, frame 0070.

II. Related Appeals And Interferences

There are no related appeals or interferences.

III. Status of Claims

The status of the claims in this application is:

A. Status of all the claims

1. Claims canceled: 1-6, 8 and 13
2. Claims withdrawn from consideration: None
3. Claims pending: 7 and 9-12
4. Claims allowed: None
5. Claims objected to: None
6. Claims rejected: 7 and 9-12

B. Claims on Appeal:

The claims on appeal are: 7 and 9-12

IV. Status of Amendments

An amendment after final rejection was filed on June 26, 2003 following the final rejection dated February 26, 2003. In an Advisory Action dated July 15, 2003, the

Examiner indicated that the amendments of the response filed on June 26, 2003 would be entered for purposes of the appeal. Thereafter, an interview with the Examiner and Applicants' Attorney took place on July 17, 2003, and on July 21, 2003, Applicants submitted proposed amendments to independent claim 7, but the proposed amendments to claim 7 was not entered by the Examiner.

V. Summary of the Invention

Initially, page and line numbers mentioned hereafter with regard to the Specification of the Application refer to the appended Appendix of Specification, which incorporates all previously entered amendments. Please note that on page 5 of the appended Appendix of Specification, "axial" (mentioned in lines 6, 7, 9, 10, 17 and 18) should be "axis", and "cutting tracks 101" (line 17) should be "cutting tracks 102", as illustrated in Figure 2. Please note these typographical errors.

The invention involves a substrate sawing process for cutting substrate areas on a substrate strip, while minimizing the accumulation of cutting error.

More specifically, the claimed invention involves a modification of the prior art process for cutting substrate areas, as illustrated in Figure 1 of the application. In the prior art process (page 1, lines 11-22) a substrate strip 100 is provided with substrate areas 110 along the longitudinal length thereof. The substrate areas 110 are provided with alignment marks 111 at corners thereof. Cutting marks 112 are provided along portions of the outer peripheries of the substrate areas 110, as illustrated in Figure 1 (Prior Art) of the application. Thereafter, a saw device is aligned to a single set of alignment marks 111 of a single substrate area 110 (i.e. the left-most substrate area 110 of Figure 1 of the application). The saw device utilizes opposing ones of the cutting marks 112 of the single substrate area 110 to create cutting tracks 101 parallel to the lateral axis of the substrate strip 100 for all of the substrate areas 110 on the substrate strip 100. Since the cutting tracks 101 for all of the substrate areas 110 on the substrate strip 100 are formed by the alignment of opposing ones of the cutting marks of only a single one of the substrate areas 110, the cutting error "A" can easily accumulate

on to subsequent substrate areas 110, as the saw device makes its cuts along the cutting tracks 101 at subsequent substrate areas 110 (page 2, lines 8-11).

The claimed invention is a major improvement over the prior art, in that the cutting error "A" will not accumulate to subsequent substrate areas 110, as the saw device makes its cuts along the cutting tracks 101. The elimination of the cutting errors is accomplished as follows. Initially the saw device is aligned to a single set of alignment marks 111 of a first substrate area 110 (i.e., the left-most substrate area on the substrate strip of Figure 2 of the application) (page 4, lines 15-19). Opposing cutting marks 112 of the first substrate area 110 are utilized by the cutting or saw device to set only the cutting tracks 101, with regard to only a first substrate area (page 2, lines 19-21). In the embodiment illustrated in Figure 2 of the application, the cutting tracks 101 that are initially formed are perpendicular to the longitudinal length of the substrate strip 110. Then the saw device is repositioned to an adjacent substrate area by aligning itself to the alignment marks 111 of the adjacent substrate area and thereafter, the process of creating the cutting tracks 101 is repeated for each individual substrate area, as the saw device is sequentially repositioned to adjacent substrate areas (page 4, lines 21-29). Therefore, the cutting error "A" that would otherwise exist in the prior art, is dramatically reduced or eliminated (page 4, lines 29-31).

As illustrated in Figure 3 of the application, in the second phase of the cutting process, the saw device measures or predetermines the cutting tracks 102 by using the cutting marks 112 of each of the substrate areas 110 and the cutting tracks 102 are restricted in each of the substrate areas 110, and the substrate strip 100 is cut along the cutting tracks 101 and the cutting tracks 102 to form the substrate of a semiconductor device (page 6, lines 4-8).

The reduction in cutting error is of critical importance because the substrate strip is initially subjected to high temperature, and when the substrate strip 100 returns to normal temperature, shrinkage in all dimensions occurs. However, each substrate strip 100 has its own unique variability which results in different dimensional amounts of shrinkage for the individual substrate strips when returning from a high temperature to a

normal temperature. Therefore, even if the substrate strips 100 are subjected to the same processes and made of the same material, the shrinkage characteristics of each individual substrate strips will be different (page 1, line 24 - page 2, line 4).

VI. Issues

The issues involved in this Appeal are:

1.) whether the subject matter of claims 7 and 9-11 is anticipated under 35 USC §102(e) by the subject matter disclosed in U.S. Patent No. 6,219,912 (Shimizu et al.), and

2.) whether the subject matter of claim 12 is rendered obvious under 35 USC §103(a) by the subject matter disclosed in U.S. Patent Nos. 6,219,912 (Shimizu et al.) and 6,047,470 (Drussel et al.).

VII. Grouping of the Claims

Appellants most respectfully submit that each of claims 7 and 9-12 do not stand or fall together.

VIII. Arguments

1. Rejection of Claims 7 and 9-11 Under 35 U.S.C. §102(e) in view of U. S. Patent No. 6,219,912 (Shimizu et al.)

MPEP § 2131 states that to anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of

terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

The reference to Shimizu et al. discloses a method of forming positioning signs 18, 18a at the same time as the electrode pads 4a by photolithography using the same mask pattern (column 13, line 43 - column 14, line 4), in order to improve the positional accuracy of the positioning signs, thereby improving the accuracy of the cut lines 2 relative to the positions of the electrodes pads 4a, since the cut lines are made between opposing pairs of positioning signs.

In the claimed invention, as illustrated in figures 2 and 3 and described in the detailed description of the specification (pages 4-6), independent claim 7 claims a process for sawing a substrate strip (100) having substrate areas (110) by a saw machine. The process comprises the steps of providing alignment marks (111) around each individual substrate area (110) on the substrate strip (100) and providing cutting marks (112) around each individual substrate area on the substrate strip (100); and positioning the saw machine with respect to each individual substrate area in accordance with the alignment marks (111) there around.

Thereafter, each individual substrate area (110) on the substrate strip (100) is cut by the saw machine respectively according to cutting tracks (101) defined by the cutting marks (112).

The substrate strip (100) has a longitudinal axis and a lateral axis and the substrate areas (110) are disposed along the longitudinal axis, and the saw machine is positioned with respect to a first substrate area (110) according to the alignment marks (111) along the longitudinal axis from one side thereof and cuts the substrate strip (100) according to cutting tracks (101) defined by the cutting marks (112) parallel to the lateral axis.

A key step in the claimed invention is the repositioning of the saw machine with respect to an adjacent one of the substrate areas (110) and cutting the substrate strip, whereby cutting error that results from each substrate area will not accumulate to the subsequent substrate areas in the substrate strip.

The Examiner has equated the positioning signs 18a of Shimizu et al. (Figure 3A)

to the alignment marks (111) of the claimed invention, and reference element 2 of Shimizu et al. (Figure 3A) to the cutting marks (112) of the claimed invention. The positioning signs 18a of Shimizu et al. can not be equated to the alignment marks 18a of the claimed invention, nor can the cut lines 2 of Shimizu et al. be equated to the cutting marks 112 of the claimed invention.

In the claimed invention, the alignment marks 111, around each individual substrate area 110 are utilized only by the saw machine to position itself over a respective substrate area 110 (page 5, lines 5-14). Thereafter, the saw machine utilizes the cutting marks 112, not the alignment marks 111, to form cutting tracks 101, along which the cuts are made, as shown in Figure 2 of the application. The alignment marks 111 of the claimed invention is used for the sole purpose of guiding the saw machine to an individual substrate area 110, and is not utilized to form any cutting tracks or cut lines. Thus the specific elements of the claimed invention are not taught by the reference to Shimizu et al.

Further, there is no disclosure in the reference to Shimizu et al. for repositioning a saw machine to individual substrate areas that are formed along a substrate strip by sequentially aligning itself to the claimed alignment marks that are around the periphery of each of the substrate areas and using the cutting marks of each of the substrate areas to form cutting tracks along which cuts are made. This claimed process is repeated in which the saw machine travels or is repositioned to an adjacent substrate area and aligns itself to the alignment marks of the adjacent substrate area. The step of repositioning the saw machine with respect to an adjacent one of the substrate areas (110) and cutting the substrate strip, whereby cutting error that results from each substrate area will not accumulate to the subsequent substrate areas in the substrate strip, is not taught by the reference to Shimizu et al., which does not specify the manner in which the cutting device could be repositioned, if at all. The reference to Shimizu et al. does not disclose an equivalent to the alignment marks (111) of the claimed invention that are utilized for the sole purpose of guiding a saw machine over individual substrate areas (110).

The Examiner has equated the cut lines 2 of Shimizu et al. to the cutting marks (112) of the claimed invention. With regard to the cut lines 2 of Shimizu et al., this can only be equated to the cutting tracks (101) of the claimed invention, which unlike the reference to Shimizu et al. is formed by aligning opposing cutting marks (112), as illustrated in Figure 2 of the application. The cut lines 2 of Shimizu et al. can not be equated to the cutting marks (112) of the claimed invention because the cut lines 2 of Shimizu et al. are predetermined or imaginary lines along which cuts are made (Figure 3A), whereas the cutting marks (112) of the claimed invention are actual, substantive marks positioned around each substrate area (110). The cut lines 2 of Shimizu et al. could only be remotely be comparable to the cutting tracks (101) of the claimed invention, which perform a similar function.

The reference to Shimizu et al does not disclose an equivalent to the alignment marks (111) of the claimed invention that guides a sawing machine to an individual substrate area (110). The alignment marks (111) of the claimed invention can not be equatable to the positioning signs 18a of Shimizu et al, nor can the cutting marks (112) of the claimed invention be equated to the cut lines 2 of Shimizu et al.

Claim 9 depends directly from claim 7, and all arguments presented previously with regard to claim 7 above is repeated with regard to claim 9. In addition, dependent claim 9 further includes the step of cutting the substrate strip (100) according to cutting tracks defined by the cutting marks (112) parallel to the longitudinal axis, as shown in Figure 2 of the application. Thus there is a two-step process for cutting the substrate strip. The reference to Shimizu et al. does not specifically teach such a two-step process for cutting the substrate strip, but recites that cutting is made along the cut lines 2 (column 13, lines 55-62). Therefore the reference to Shimizu et al. can not anticipate all of the elements of claim 9.

Claim 10 depends directly from claim 7, and all arguments presented previously with regard to claim 7 above is repeated with regard to claim 10. In addition,

dependent claim 10 recites that each individual substrate area (110) is provided with at least three alignment marks (111), as shown in Figure 2. The alignment marks (111) consist of at least three points arranged around the substrate area (110) of the substrate (100). As previously stated with regard to the arguments presented for claim 7, since there is no equivalent to the claimed alignment marks in the reference to Shimizu et al., this reference can not anticipate claim 10 wherein "each individual substrate area is provided with at least three alignment marks".

Claim 11 depends directly from claim 7, and all arguments presented previously with regard to claim 7 above is repeated with regard to claim 11. In addition, dependent claim 11 recites that each individual substrate area (110) is provided with an encapsulated area having at least three alignment marks (111) there around, as shown in Figure 2 (page 4, line 32- page 5, line 2). The encapsulated area is approximate to a substrate area (110). The alignment marks (111) consist of at least three points arranged around the encapsulated area of the substrate (100). As previously stated with regard to the arguments presented for claim 7, since there is no equivalent to the claimed alignment marks in the reference to Shimizu et al., this reference can not anticipate claim 11 wherein "the encapsulated area is provided with at least three alignment marks".

Further, with regard to claims 7, 10 and 11, because the Shimizu et al. reference teaches only positioning signs 18a, which can only remotely be compared to the cutting marks (112) of the claimed invention, and neither discloses any equivalent to the alignment marks (111) of the claimed invention, nor a method of aligning a sawing device according to the alignment marks initially, and thereafter forming cutting tracks according to opposing ones of the cutting marks, and then repositioning the sawing device to an adjacent substrate area according to the alignment marks of the adjacent substrate area, the Shimizu et al. reference cannot be an anticipating reference under 35 U.S.C. § 102. The Shimizu et al. reference teaches only a method of forming

positioning signs via photolithography in order to improve the accuracy of the cuts made between the positioning signs, and is not concerned with any means for first guiding a sawing device to a particular individual substrate area and repositioning the sawing device to an adjacent substrate area. In the absence of any equatable alignment marks that guide the sawing device to individual substrate areas in sequence and the step of repositioning the sawing device to an adjacent substrate area according to alignment marks on the adjacent substrate area, the reference to Shimizu et al. cannot anticipate the claimed invention, and reversal of the rejection of claims 7 and 9-11 is respectfully requested.

2. Rejection of Claim 12 Under 35 U.S.C. §103(a) in view of U. S. Patent No. 6,219,912 (Shimizu et al.) and U.S. Patent No. 6,047,470 (Drussel et al.)

MPEP § 2131 states that to establish a prima facie case of obviousness, three basic criteria must be met. First there must be some suggestion or motivation, either in the prior art references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine the teachings of the reference. Second, there must be a reasonable expectation of success for the modification. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Further, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

MPEP § 2143.03 states that all claimed limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art". *In re Wilson* 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is non-obvious under 35 U.S.C. § 103, then any claim depending therefrom is non-obvious. In re Fine 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Claim 12 recites that two substrate strips are juxtaposed for cutting simultaneously, as illustrated in Figure 4 and described in page 6, lines 10-14 of the specification. Claim 12 depends from claim 7.

Reversal of this rejection is respectfully requested on the grounds that the Drussel et al. patent, like the Shimizu et al. patent, fails to disclose or suggest, whether considered individually or in any reasonable combination, alignment marks around each individual substrate area on the substrate strip, which is utilized by a cutting machine to position itself on a respective one of the substrate areas on the substrate strip according to the alignment marks, thereafter cutting the substrate strip according to cutting tracks defined by the cutting marks parallel to the lateral axis of the substrate strip, and repositioning itself to an adjacent substrate area, as recited in claim 7.

The Examiner alleges that the reference to Shimizu et al. discloses the method substantially as claimed except for two substrate strips juxtaposed for cutting.. As previously argued, the reference to Shimizu et al. can not anticipate all of the elements of independent claim 7, and is therefore deficient with regard to claims 7 and 9-11.

The Examiner alleges that the reference to Drussel et al. teaches the use of a method of using two substrate strips juxtaposed for cutting for the purpose of increasing production. The reference to Drussel et al. does not provide for the missing elements of Shimizu et al., in order to obviate any of the pending claims, including claim 12.

Figure 5 of Drussel et al. discloses a stack of circuit board substrate assemblies that may be singulated or cut at the same. The dictionary definition of the word "juxtaposed" is to place close together or side-by-side (see appended Appendix of Dictionary Definition). As inferred from Figure 4 of the application, the meaning of the word "juxtaposed" is to place side-by-side, and not to stack the substrate strips. There is no disclosure in the reference to Drussel et al. to place substrate strips side-by-side.

Even if one were to find support to place the substrate strips side-by-side in the reference to Drussel et al., all of the claimed elements of independent claim 7 from which claim 12 depends from, are not satisfied by the base reference to Shimizu et al., alone or in combination with the reference to Drussel et al.

Because neither the Shimizu et al. nor Drussel et al. references discloses or suggests the claimed process for sawing a substrate strip, reversal of the rejection of claim 12 under 35 U.S.C. § 103(a) is respectfully requested.

IX. Conclusion

For all of the foregoing reasons, Appellants respectfully submit that the Examiner's final rejections of claims 7 and 9-12 under 35 U.S.C. §§ 102 (e) and103(a) are improper and should be reversed by this Honorable Board.

Respectfully submitted,

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X. APPENDIX OF CLAIMS

1-6 (Canceled)

7. A process for sawing a substrate strip having a plurality of substrate areas by a saw machine, and the process comprising the steps of:

providing a plurality of alignment marks around each individual substrate area on the substrate strip;

providing a plurality of cutting marks around each individual substrate area on the substrate strip;

positioning the saw machine with respect to each individual substrate area in accordance with the alignment marks there around;

cutting each individual substrate area on the substrate strip by the saw machine respectively according to cutting tracks defined by the cutting marks;

wherein the substrate strip has a longitudinal axis and a lateral axis and the substrate areas are disposed along the longitudinal axis, the saw machine is positioned with respect to a first substrate area according to the alignment marks along the longitudinal axial from one side thereof and cuts the substrate strip according to cutting tracks defined by the cutting marks parallel to the lateral axis;

repositioning the saw machine with respect to an adjacent one of the substrate areas; and

cutting the substrate strip, whereby cutting error that results from each substrate area will not accumulate to the subsequent substrate areas in the substrate strip.

8. (Canceled)

9. The process as claimed in claim 7, further comprising the step of cutting the substrate strip according to cutting tracks defined by the cutting marks parallel to the longitudinal axis.

10. The process as claimed in claim 7, wherein each individual substrate area is provided with at least three alignment marks.

11. The process as claimed in claim 7, further comprising an encapsulated area on each individual substrate area, and the encapsulated area is provided with at least threAppendix of Claims.wpde alignment marks there around.

12. The process as claimed in claim 7, wherein two substrate strips are juxtaposed for cutting simultaneously.

13. (Canceled)

XI.

APPENDIX OF SPECIFICATION

(Incorporating All Previously Entered Amendments)

PROCESS FOR SAWING SUBSTRATE STRIP

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a substrate sawing process and more particularly to a process for sawing a substrate strip having multi-alignment marks thereon.

2. Description of the Related Art

A conventional substrate sawing process comprises an alignment for positioning a substrate strip so as to adjust the position of a saw machine and to arrange the position of the cutting tracks for substrate sawing. As shown in FIG. 1, a substrate strip 100 comprises a plurality of substrate areas 110 which are aligned along the longitudinal direction. The substrate areas 110 have a plurality of alignment marks 111 for positioning a saw machine and cutting marks 112 which are provided for measuring or predetermining arrangement of the cutting tracks 101 of the substrate sawing process. After the saw machine is positioned and the cutting tracks 101 are arranged, the saw machine saws the substrate strip 100 along the cutting track 101 which is defined by the cutting marks 112. However, the saw machine can choose only a set of the outermost alignment marks 111 of the substrate strip 100 to define a reference point and utilizes the cutting marks 112, located around the substrate areas 110, to predetermine the cutting tracks 101 in the first phase and the cutting tracks (not shown) in the second phase.

The substrate strip 100 is packaged in high temperature circumstances and results in an expansion. When the substrate strip 100 returns to normal temperature, shrinkage in all dimensions occurs. However, each strip has variability which results in

different amounts of shrinkage of the substrate strips 100 when returning from high temperature to normal temperature. Even if the substrate strips 100 are controlled in the same process and made of the same material, the shrinkage of the substrate strip 100 is still different. Therefore, each substrate strip 100 needs to be measured to define the cutting tracks in the first phase and the second phase. Then the saw machine detects the reference point of the alignment of the substrate areas 110 and moves to the predetermined position to cut the substrate strip 100 along the cutting tracks 101. Because the saw machine cuts the substrate strips 100 (which have different shrinkage) by the predetermined cutting tracks 101, the cutting error A of each substrate area 110 adds to the peripheral substrate areas 110 in all dimensions on the substrate strips l00, even though the cutting tracks are predetermined.

SUMMARY OF THE INVENTION

The present invention intends to provide a substrate sawing process that saws the substrate strips in alignment with each of the substrate areas. The saw machine is mechanically moved to the substrate areas and is positioned by the alignment of each of the substrate areas for the substrate sawing process. This reduces the cutting error in such a way as to mitigate and overcome the above problem. Because the saw machine is positioned on each of the substrate areas by corresponding alignment, a cutting error resulting from cutting of each substrate area cannot add to the peripheral substrate areas.

The primary objective of this invention is to provide a substrate sawing process for a strip of substrate that includes multi-alignment so a sawing machine can be mechanically moved to the substrate areas and can be positioned by the corresponding alignments of each of the substrate areas to reduce the cutting error. Because the saw machine is positioned on each substrate areas by corresponding alignment, a cutting error in any of the substrate areas will not accumulate to the subsequent substrate areas or substrate strips.

According to the embodiment of the present invention the substrate sawing

process mainly includes the steps of providing multi-alignment marks corresponding to a plurality of substrate areas of substrate strips which are arranged side-by-side on a plate. A saw machine is mechanically moved to the substrate areas and is positioned by the alignments of corresponding substrate areas for cutting the substrate areas of the substrate strips in the first phase. And then the saw machine is further mechanically moved to the substrate areas again and is positioned by the alignments of corresponding substrate areas again for cutting the substrate areas of the strips in the second phase. Therefore, a cutting error in any of the substrate areas in the first phase and second phase will not accumulate to the subsequent substrate areas in the substrate strip.

Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description and the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described in detail with reference to the accompanying drawing herein;

FIG. 1 is a top view of a plurality of cutting tracks of a strip;

FIG. 2 is a top view of the cutting tracks of a substrate strip in the first phase in accordance with the first embodiment of the present invention;

FIG. 3 is a top view of the cutting tracks of a substrate strip in the second phase in accordance with the first embodiment of the present invention;

FIG. 4 is a top view of the cutting tracks of a substrate strip in the first phase in accordance with the second embodiment of the present invention; and

FIG. 5. is a top view of the cutting tracks of a substrate strip in the second phase in accordance with the second embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The substrate sawing process of the present invention mainly includes multi-alignment marks corresponding to a plurality of substrate areas of substrate strip or strips which are arranged side by side on a plate. A saw machine is mechanically moved to the substrate areas and is positioned by the alignments of corresponding substrate areas to cut the substrate areas of the substrate strip according to prior art in the first phase. Then the saw machine is further mechanically moved to the substrate areas again and is positioned by the alignments of corresponding substrate areas again to cut the substrate areas of the strips in the second phase.

Referring to FIG. 2, according to the first embodiment of the process for sawing substrate strip, a substrate strip 100 is placed on a plate (not shown) and is preferably suctioned to attach to the top surface of the plate through the air-holes arranged on the plate. The substrate strip 100 comprises a plurality of substrate areas 110 which are aligned in the longitudinal direction and a plurality of alignment marks 111 which are arranged around the substrate areas 110. A saw machine (not shown) is mechanically moved to the substrate areas 110 and is positioned by the alignment marks 111 of corresponding substrate areas 110. Then the saw machine measures or predetermines the cutting tracks 101 by cutting marks 112 of each substrate area 110, and then cuts the substrate areas 110 of the substrate strip 100 in the first phase. The saw machine is positioned with respect to each individual substrate area 110 according to the alignment marks 111 thereof and then the cutting tracks 101 in the first phase is defined by the cutting marks 112 on the substrate strip 100. Even though each of the strips 100 has unpredictable shrinkage caused by returning from high temperature to normal temperature, the saw machine is adjustably positioned in each of the substrate areas 110 by corresponding alignment marks 111 to avoid the error of each of the substrate areas 110 from accumulating to the subsequent substrate areas 110 during the next substrate sawing process. Therefore, the cutting error A of the substrate areas 110 is smaller than a, predetermined value to provide accurate and controlled dimensions of the substrate. The alignment substantially consists of at least three points which are arranged around the encapsulated area of the substrate, and the cutting track

substantially consists of two cutting marks which are arranged in the area formed by the alignment. Then the saw machine finds the reference point of alignment of each of the substrate strips 100 and cuts each strip 100 along the predetermined cutting tracks in the first phase and the second phase to provide accurate and controlled dimensions of the singulated substrate. According to the preferred embodiment as shown in Fig. 2, the substrate strip 100 has a longitudinal axial and a lateral axial and the substrate areas 110 are disposed along the longitudinal axial, the saw machine is positioned with respect to the first substrate area 110 according to the alignment marks 111 along the longitudinal axial from the left and cuts the substrate strip 100 according to cutting tracks 101 defined by the cutting marks 112 parallel to the lateral axial. Then, the saw machine is positioned with respect to the second substrate area 110 from the left and then cuts the substrate strip l00. Therefore, the cutting error resulted from each substrate area 110 will not accumulate to the subsequent substrate areas in the substrate strip 100, thereby ensuring the cutting accuracy for the packaged substrate. Referring to Fig. 3, after all substrate areas 110 are cut in the lateral direction of the substrate strip 100, the saw machine cuts the substrate strip 100 along the longitudinal axial thereof according to cutting tracks 101 defined by the cutting marks 112 parallel to the longitudinal axial.

Comparing FIG. 1 with FIG. 2, the, conventional sawing process differs from the present invention in that the saw machine can choose only a set of the outermost alignment marks 111 of the substrate strip 100 to define a reference point and then utilizes the cutting marks 112, located around the substrate areas 110, to predetermine the cutting tracks 101 in the first phase. Because the substrate strips 100, which have unpredictable shrinkage, fail to contact the predetermined cutting tracks 101, accurate and controlled dimensions of the singulated substrate cannot be provided, and it cannot be applied to cut the substrate strip having a plurality of substrate areas. However, the saw machine of the present invention is mechanically moved to the substrate areas 110 and is positioned by the alignment marks 111 of corresponding substrate areas 110 on which are arrayed a plurality of substrates in equidistance. Therefore it is easy to measure the cutting marks 112 to define the cutting tracks 101, and the saw machine cuts each substrate strip 100 along the cutting tracks 101. The cutting error A of the

substrate areas 110 is smaller than a predetermined value to provide accurate and controlled dimensions of the substrate.

Referring to FIG. 3, the saw machine measures or predetermines the cutting tracks 102 by cutting marks 112 of each of the substrate areas 110 in the second phase, and the cutting tracks 102 are restricted in each of the substrate areas 110. The substrate strip 100 is cut along the cutting tracks 101 and the cutting tracks 102 to form the substrate of the semiconductor device.

Referring to FIG. 4, according to the second embodiment of the process for sawing substrate strip, two substrate strips 100 and 200 are juxtaposed on a plate (not shown). The substrate strips 100 and 200 have a plurality of substrate areas 110 and 210 which are adjacent to one another. The saw machine cuts the substrate strips 100 and 200 along the cutting tracks 101 in the first phase.

Referring to FIG. 5, the saw machine cuts the substrate strips 100 and 200 along the cutting tracks 102 in the second phase which is restricted in each of the substrate areas 110 and 210. The substrate strips 100 and 200 are cut along the cutting tracks 101 and the cutting tracks 102 to form the substrate of the semiconductor device. Then the saw machine finds the reference point of alignment of each of the substrate strips 100 and 200 and cuts each substrate strip 100 and 200 along the predetermined cutting tracks in the first phase and the second phase.

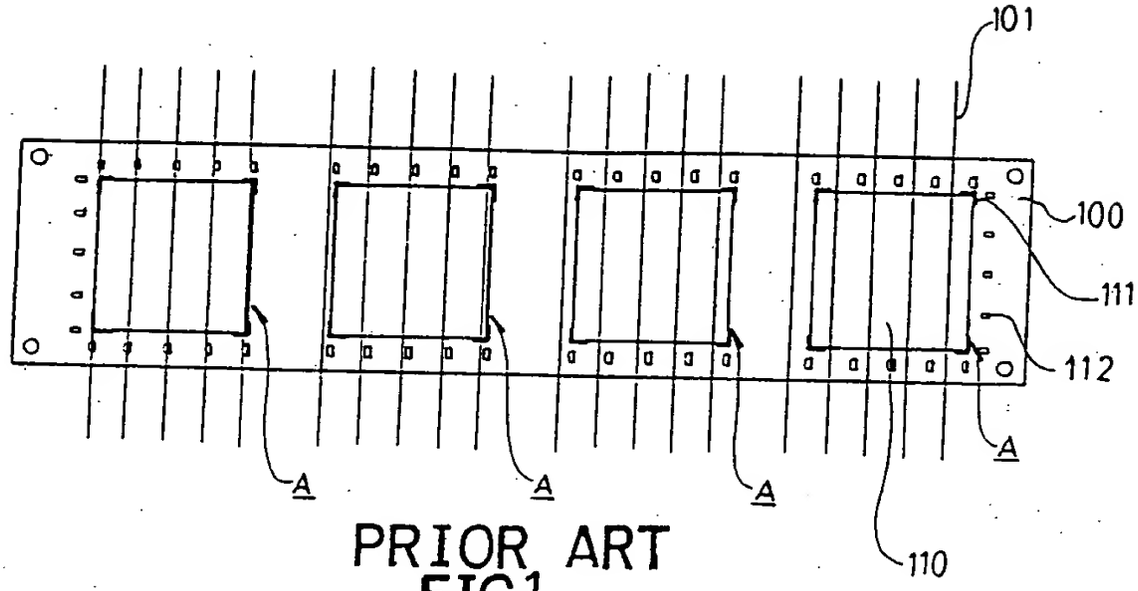
Although the invention has been described in detail with reference to its present preferred embodiment, it will be understood by one of ordinary skill in the art that various modifications can be made without departing from the spirit, and the scope of the invention, as set forth in the appended claims.

XII. APPENDIX OF ABSTRACT (As Previously Amended)

ABSTRACT OF THE DISCLOSURE

A process for sawing a substrate strip marks corresponding to substrate areas of substrate strips which are arranged side-by-side on a plate. A saw machine is mechanically moved to the substrate areas and positioned by the alignment marks of corresponding substrate areas for cutting the substrate areas of the substrate strips in the first phase. Then the saw machine is further mechanically moved to the substrate areas again and is positioned by the alignment marks of corresponding substrate areas again for cutting the substrate areas of the substrate strips in the second phase. Therefore, an error in any of the substrate areas in the first phase and second phase will not accumulate to the subsequent substrate areas in the substrate strip.

XIII. APPENDIX OF DRAWINGS (As Originally Filed)



PRIOR ART
FIG.1

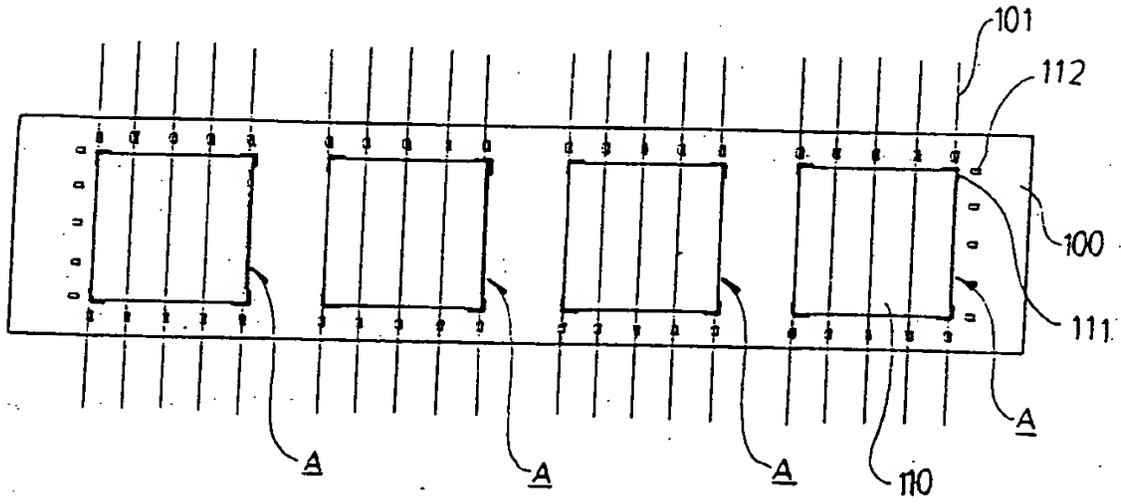


FIG.2

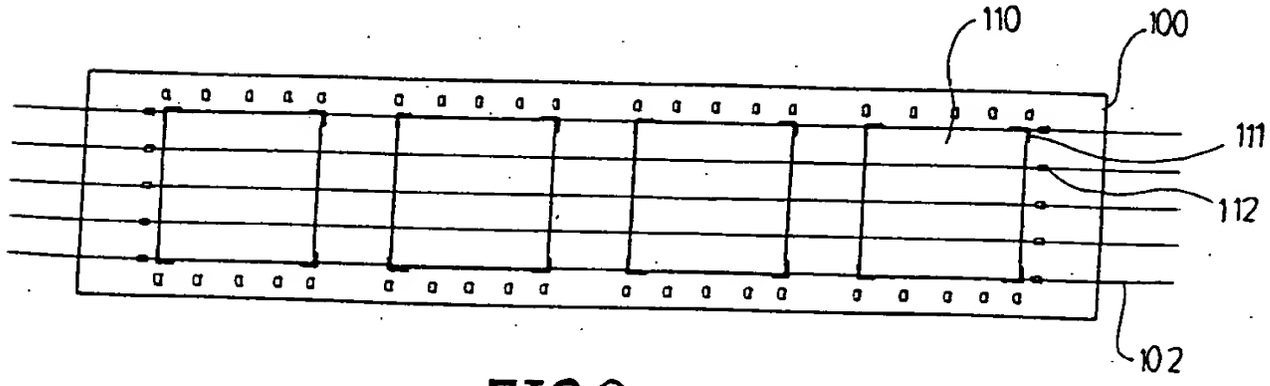


FIG.3

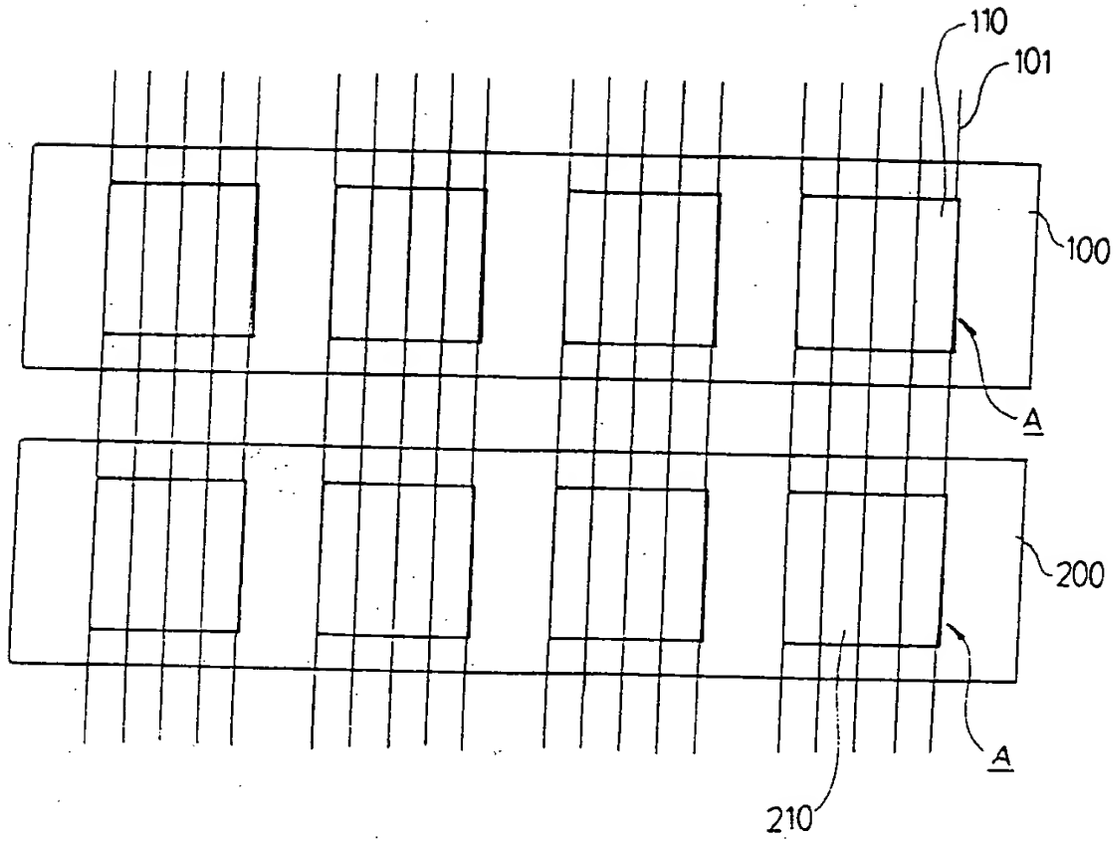


FIG.4

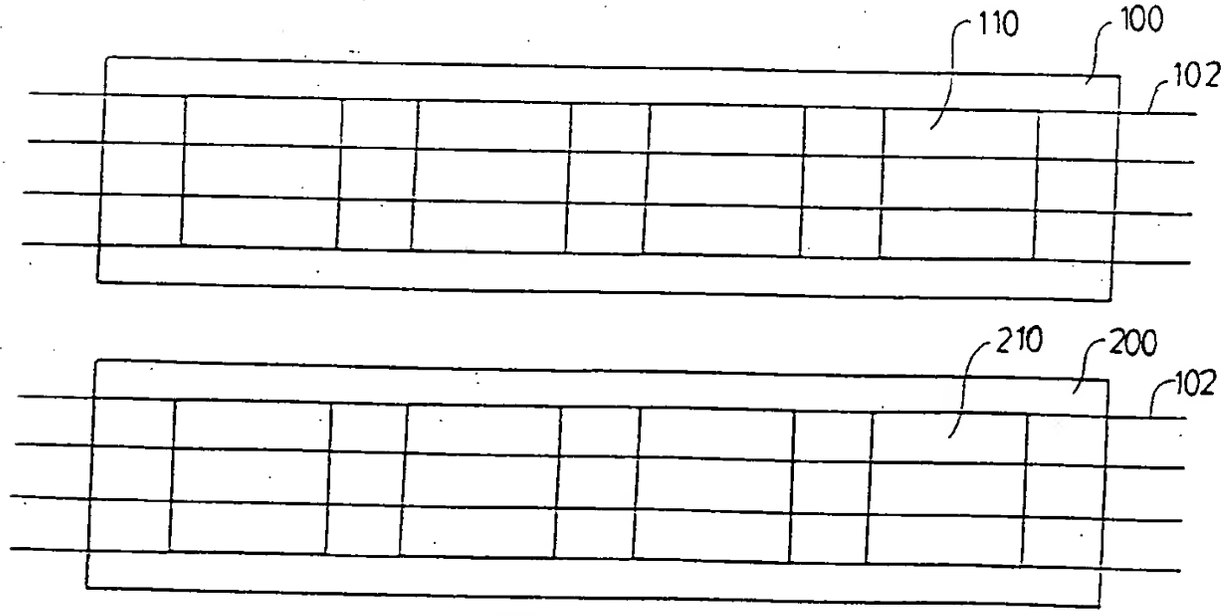


FIG.5

WEBSTER'S ENCYCLOPEDIC UNABRIDGED DICTIONARY OF THE ENGLISH LANGUAGE

The dictionary entries are based on the Second Edition of
The Random House Dictionary of the English Language

GRAMERCY BOOKS
New York • Avenel

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ju·ve·nile (jōō′və nl, -nīl′), *adj.* **1.** of, pertaining to, characteristic of, or suitable or intended for young persons: *juvenile books.* **2.** young; youthful: *juvenile years.* **3.** immature; childish; infantile: *His juvenile tantrums are not in keeping with his age.* —*n.* **4.** a young person; youth. **5.** *Theat.* **a.** a youthful male or female role. **b.** an actor or actress who plays such parts. **6.** a book for children. **7.** *Ornith.* a young bird in the stage when it has fledged, if altricial, or has replaced down of hatchling if precocial. **8.** a two-year-old racehorse. [1615–25; < L *juvenilis* youthful, equiv. to *juven(is)* youthful + *-ilis* -ILE] —**ju′ve·nile·ly,** *adv.*

—**Syn.** 1. See **young.**

ju′venile court′, a law court having jurisdiction over youths, generally of less than 18 years. [1895–1900, *Amer.*]

ju′venile delin′quency, behavior of a child or youth that is so marked by violation of law, persistent mischievousness, antisocial behavior, disobedience, or intractability as to thwart correction by parents and to constitute a matter for action by the juvenile courts. [1810–20]

ju′venile delin′quent, **1.** a minor who cannot be controlled by parental authority and commits antisocial or criminal acts, as vandalism or violence. **2.** a child or youth characterized by juvenile delinquency. [1810–20]

ju′venile hor′mone, *Biochem.* any of a class of insect and plant hormones acting to inhibit the molting of a juvenile insect into its adult form. [1935–40]

ju′venile of′ficer, a police officer concerned with juvenile delinquents. [1950–55]

ju′ve·nile-on′set dia·be′tes (jōō′və nl on′set′, -ōn′-, -nīl′-), *Pathol.* diabetes (def. 3). [1975–80]

ju′venile rheu′matoid arthri′tis, *Pathol.* rheumatoid arthritis that begins before puberty, often preceded by such symptoms as fever, patchy rash, and weight loss. [1965–70]

ju·ve·nil·i·a (jōō′və nil′ē ə, -nil′yə), *n.pl.* **1.** works, esp. writings, produced in one's youth: *His juvenilia were more successful than his mature writings.* **2.** literary or artistic productions suitable or designed for the young: *publishers of juvenilia.* [1615–25; < L, n. use of neut. pl. of *juvenilis* JUVENILE]

ju·ve·nil·i·ty (jōō′və nil′i tē), *n., pl.* **-ties.** **1.** juvenile state, character, or manner. **2. juvenilities,** youthful qualities or acts. **3.** an instance of being juvenile. [1615–25; JUVENILE + -ITY]

ju·ve·nil·ize (jōō′və nl īz′), *v.t.,* **-ized, -iz·ing.** **1.** to make juvenile or immature: *to juvenilize the classics for quick reading.* **2.** to make suitable for or more appealing to children. Also, esp. *Brit.,* **ju′ve·nil·ise′.** [1825–35; JUVENILE + -IZE] —**ju′ve·nil·i·za′tion,** *n.*

Ju·ven·ta Fons (yōō ven′tä fons′), an area in the southern hemisphere of Mars, appearing as a dark region when viewed through a telescope.

jux·ta·pose (juk′stə pōz′, juk′stə pōz′), *v.t.,* **-posed, -pos·ing.** to place close together or side by side, esp. for comparison or contrast. [1850–55; back formation from JUXTAPOSITION]

jux·ta·po·si·tion (juk′stə pə zish′ən), *n.* **1.** an act or instance of placing close together or side by side, esp. for comparison or contrast. **2.** the state of being close together or side by side. [1655–65; < F < L *juxtā* side by side + F *position* POSITION] —**jux′ta·po·si′tion·al,** *adj.*

JV, **1.** See **joint venture.** **2.** junior varsity. Also, **J.V.**

jwlr., jeweler.

J.W.V., Jewish War Veterans.

Jy, jansky; janskies.

Jy., July.

Jyl·land (yʏl′län), *n.* Danish name of **Jutland.**

Jy·väs·ky·lä (yʏ′vəs·kʏ′la), *n.* a city in S central Finland. 64,500.